

## CLAIMS

1. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period  $\Lambda$  is formed in a substrate, a cross section of the grating pattern having a rectangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern,  $\Lambda \cos \theta_0 < \lambda$  where  $\lambda$  is a wavelength and  $\theta_0$  is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value while transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value.

2. A polarizing element according to claim 1, wherein the predetermined value is 0.8.

3. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period  $\Lambda$  is formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern,  $\Lambda \cos \theta_0 < \lambda$  where  $\lambda$  is a wavelength and  $\theta_0$  is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of one of TE polarization and TM polarization is not lower than a predetermined value while transmission efficiency of zero-order diffracted light of the other of TE polarization and TM polarization is not lower than the predetermined value.

4. A polarizing element according to claim 3, wherein the predetermined value is 0.7.

5 5. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period  $\Lambda$  is formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, in the case where a first  
10 wavelength  $\lambda_1$  and a second wavelength  $\lambda_2$  satisfy a relationship of  $\lambda_1 < \lambda_2$ ,  $\Lambda \cos \theta_0 < \lambda_1$  where  $\theta_0$  is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value for the first wavelength  $\lambda_1$  while  
15 transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value for the first wavelength  $\lambda_1$ , and such that transmission efficiency of the zero-order diffracted light of the TE polarization is not lower than the predetermined value for the second wavelength  $\lambda_2$  while reflection efficiency of the zero-order diffracted light of  
20 TM polarization is not lower than the predetermined value for the second wavelength  $\lambda_2$ .

6. A polarizing element according to claim 5, wherein the predetermined value is 0.7.

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7. A polarizing element, wherein the polarizing element has a two-layer structure in which a grating pattern having a constant period  $\Lambda$  is

formed in a substrate, a cross section of the grating pattern having a triangular shape, and a film having a refractive index higher than that of the substrate is deposited on the grating pattern, in the case where a first wavelength  $\lambda_1$  and a second wavelength  $\lambda_2$  satisfy a relationship of  $\lambda_1 < \lambda_2$ ,  $\Lambda \cos \theta_0 < \lambda_1$  where  $\theta_0$  is an angle of incidence to a grating surface, and the grating period, a grating height, and a film thickness are determined such that reflection efficiency of zero-order diffracted light of TE polarization is not lower than a predetermined value for the first wavelength  $\lambda_1$  while transmission efficiency of zero-order diffracted light of TM polarization is not lower than the predetermined value for the first wavelength  $\lambda_1$ , and such that reflection efficiency of the zero-order diffracted light of TE polarization is not lower than the predetermined value for the second wavelength  $\lambda_2$  while transmission efficiency of the zero-order diffracted light of TM polarization is not lower than the predetermined value for the second wavelength  $\lambda_2$ .

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8. A polarizing element according to claim 7, wherein the predetermined value is 0.7.

9. A polarizing element according to any one of claims 1 to 8, wherein the substrate is made of a synthetic resin.

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10. A polarizing element according to claim 9, wherein the substrate is made of a transparent resin such as acryl and polyolefin.

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11. A polarizing element according to any one of claims 1 to 10, wherein the grating pattern of the substrate is formed by transfer from a metal mold.

12. A polarizing element according to any one of claims 1 to 11, wherein the film is a deposited film.

5           13. A polarizing element according to claim 12, wherein the deposited film is made of a material such as  $\text{TiO}_2$  having a refractive index higher than a refractive index of the substrate.

10           14. A polarizing element according to claims 12 or 13, wherein a thickness of the deposited film is smaller than 0.3 micrometers.

15           15. A polarizing element according to any one of claims 1 to 14, wherein the grating height is smaller than the grating period.

            16. A polarizing element according to any one of claims 5 to 8, wherein the first wavelength is the wavelength for a digital versatile disc and the second wavelength is the wavelength for a compact disc.

20           17. An optical system including a first-wavelength light source, a second-wavelength light source, and a polarizing element according to any one of claims 1 to 8, wherein the polarizing element is configured to reflect light from the light source of any wavelength in order to cause the light to reach to a disc and to transmit the return light reflected by the disc.

25           18. An optical system including a first-wavelength light source, a second-wavelength light source, and a polarizing element according to any one of claims 5 to 8, wherein the polarizing element is configured to reflect

light from the first-wavelength light source and the second-wavelength light source in order to cause the light to reach to a disc and to transmit the return lights reflected by the disc.